



Design and evaluation of a porous burner for the mitigation of anthropogenic methane emissions

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Abstract:

Methane constitutes 15% of total global anthropogenic greenhouse gas emissions. The mitigation of these emissions could have a significant near-term effect on slowing global warming, and recovering and burning the methane would allow a wasted energy resource to be exploited. The typically low and fluctuating energy content of the emission streams makes combustion difficult; however porous burners—an advanced combustion technology capable of burning low-calorific value fuels below the conventional flammability limit—are one possible mitigation solution. Here we discuss a pilot-scale porous burner designed for this purpose. The burner comprises a cylindrical combustion chamber filled with a porous bed of alumina saddles, combined with an arrangement of heat exchanger tubes for preheating the incoming emission stream. A computational fluid dynamics model was developed to aid in the design process. Results illustrating the burner's stable operating range and behavior are presented: stable ultralean combustion is demonstrated at natural gas concentrations as low as 2.3 vol%, with transient combustion at concentrations down to 1.1 vol%; the system is comparatively stable to perturbations in the operating conditions, and emissions of both carbon monoxide and unburned hydrocarbons are negligible. Based on this pilot-scale demonstration, porous burners show potential as a methane mitigation technology.

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Resource Description

Exposure :

weather or climate related pathway by which climate change affects health

Unspecified Exposure

Geographic Feature:

resource focuses on specific type of geography

None or Unspecified

Geographic Location:

resource focuses on specific location

Non-United States

Non-United States: Australasia

Climate Change and Human Health Literature Portal

Health Impact:

specification of health effect or disease related to climate change exposure

Health Outcome Unspecified

Intervention:

strategy to prepare for or reduce the impact of climate change on health

A focus of content

Mitigation/Adaptation:

mitigation or adaptation strategy is a focus of resource

Mitigation

Resource Type:

format or standard characteristic of resource

Research Article, Research Article

Timescale:

time period studied

Time Scale Unspecified